

Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 1 *Cattleman's Day (1993-2014)*

Article 887

1989

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K.K. Bolsen

A. Laytimi

Ronald V. Pope

See next page for additional authors

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Recommended Citation

Bolsen, K.K.; Laytimi, A.; Pope, Ronald V.; and Riley, Jack G. (1989) "Effect of inoculants and NPN additives on dry matter recovery and cattle performance: a summary of 22 trials," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 1. <https://doi.org/10.4148/2378-5977.2290>

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Abstract

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Keywords

Cattlemen's Day, 1989; Kansas Agricultural Experiment Station contribution; no. 89-567-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 567; Beef; Inoculants; Non-protein nitrogen (NPN); Performance

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Authors

K.K. Bolsen, A. Laytimi, Ronald V. Pope, and Jack G. Riley

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EFFECT OF INOCULANTS AND NPN ADDITIVES ON DRY MATTER RECOVERY AND CATTLE PERFORMANCE: A SUMMARY OF 22 TRIALS

**K.K. Bolsen, A. Laytimi,
R. Pope, and J.G. Riley**

Summary

Results from 22 trials comparing dry matter (DM) recovery and cattle performance of inoculated or non-protein nitrogen (NPN)-treated silages to controls were summarized using paired t-test analysis. Inoculants consistently improved DM recoveries and gains per ton of crop ensiled in both corn and forage sorghums. The use of NPN adversely affected nutrient preservation and gain per ton of crop ensiled, particularly for the wetter forage sorghums.

Introduction

Silage additives have received fairly wide acceptance in the U.S. A recently published guide¹ to over 150 commercial additives indicated that microbial inoculants were the most numerous active ingredients in the products marketed today. Inoculants should promote a faster and more efficient fermentation of the ensiled material, which would increase both the quantity and quality of the silage as fed. Urea and other non-protein nitrogen (NPN) sources have been added to low-protein crops (i.e., corn and sorghum) to increase their protein equivalent and decrease supplemental protein costs.

Research with inoculant and NPN additives using the farm-scale silos in Manhattan and at the Fort Hays and Southeast Branch Experiment Stations began about 15 years ago. Summarized here are results of 22 trials in which dry matter recovery and cattle performance from inoculant and NPN silages were compared to untreated (control) silages.

Experimental Procedures and Results

Results of corn silage trials are in Table 20.1, while results of forage sorghum silage trials are in Table 20.2. In 19 of the 22 trials, silages were made by the alternate load method. In sorghum Trials 2, 3, and 10, control and treated silages were made on consecutive days. Upright, concrete stave silos were used in all but one trial; in sorghum Trial 10 both silages were made in AgBags®. Further details of all other procedures are given in the Report of Progress listed for each trial. Products from 10 companies were used in the corn silage trials and products from eight companies in the sorghum trials.

¹K.K. Bolsen and J. I. Heidker, 1985. Silage Additives USA, Chalcombe Publications, 13 Highwoods Drive, Marlow Bottoms, Marlow, Berks, United Kingdom SL73PU.

Statistical analysis of the data from the 12 corn silage trials and 10 forage sorghum trials was conducted using paired t-test. Only overall mean comparisons were made between paired observations for the five criteria measured.

A summary of treatment means for control and treated silages and significance levels is shown in Table 20.3.

The 16 inoculated corn silages had a 1.45 percentage unit higher ($P<.001$) DM recovery compared to untreated silages and the inoculated silages supported a .07 lb faster ($P<.01$) daily gain and a 3.5 lb increase ($P<.001$) gain per ton of crop ensiled.

The addition of Cold-flo ammonia did not influence any of the five criteria in the corn silage trials ($P<.05$); however, there was a strong trend for both DM recovery and gain per ton of crop ensiled to be lower; 2.2 percentage units and 6.3 lb ($P<.07$), respectively.

When untreated and inoculated forage sorghums were compared, inoculants increased ($P<.01$) DM recovery, improved ($P<.03$) feed conversion, and produced 4.9 lb more ($P<.001$) gain per ton of crop ensiled. The NPN-treated forage sorghum silages had a 4.8 percentage unit lower ($P<.001$) DM recovery, although cattle performance was not significantly affected.



Table 20.1. Effect of Inoculants and Non-protein Nitrogen Additions on Dry Matter Recovery and Cattle Performance in 12 Trials with Corn Silages

Trial No., Year, and Rpt. of Progress No. ¹	Treatment ²	DM Recovery ³	Avg. Daily Gain, lb	Daily DM Intake, lb	DM Feed/lb of Gain, lb	Gain/Ton of Crop Ensiled, lb
1. 1978:377	Control (44,15,112)	88.7	2.15	15.6	7.28	97.3
	Sila-bac	91.7	2.15	15.9	7.41	98.2
	Silo-Best	91.3	2.15	16.4	7.68*	95.0
	Cold-flo	91.5	2.04	16.2	7.93*	91.6
2. 1979:394	Control (37,20,78)	93.3	2.46	18.9	7.72	93.7
	EnsilaPlus	94.1	2.50	19.2	7.95	91.6
	Cold-flo	88.5	2.38	19.7	8.10	84.2
3. 1980:413	Control (33,16,77)	87.3	2.94	21.1	7.17	87.9
	Silo-Best	88.7	3.00	20.3	6.77*	95.1
	Sila-ferm	87.4	3.06	20.9	6.80*	92.3
4. 1981:448	Control (36,24,110)	89.0	2.18	14.6	6.56	90.5
	1177	91.4	2.22	14.8	6.73	95.8
5. 1983:470	Control (40,24,84)	92.2	2.28	15.2	6.66	109.7
	H/M Inoculant	93.0	2.43*	15.9	6.56	112.0
6. 1984:494	Control (33,16,84)	85.5	2.29	14.7	6.43	106.5
	Silo-Best Sol.	88.6	2.30	15.1	6.53	107.2
7. 1985:514	Control (36,15,84)	91.9	2.76	18.9	6.88	106.8
	USO ₃ M	93.0	2.97	19.4	6.53	114.1
	Silo-Best Sol.	92.2	2.70	18.4	6.81	107.8
8. 1985:514 ^A	Control (40,18,120)	86.6	2.00	15.8	7.88	85.3
	Garst M-74	88.1	1.99	16.5	8.29	82.7
9. 1986:539	Control (36,16,80)	90.5	2.54	16.3	6.46	113.0
	Ecosyl	92.8	2.76	17.2	6.26	119.3
10. 1986:539	Control (39,16,80)	93.0	2.53	17.0	6.77	110.6
	Biomate	93.8	2.62	17.3	6.62	113.2
	Silagest	93.9	2.71	17.0	6.30	119.8
11. 1987:567	Control (38,15,84)	94.3	1.95	15.5	7.95	94.6
	Ecosyl	95.8	2.06	15.5	7.52	101.8
12. 1987:567	Control (38,15,84)	92.5	2.26	17.1	7.55	97.7
	Biomate	93.2	2.24	15.8*	7.05	105.7
	Biomate + Cold-flo	88.2	2.25	16.8	7.48	94.2

¹Identifies the KAES Report of Progress which contains detailed procedures and results for each trial.

²In parenthesis are the percent dry matter of the pre-ensiled crop, the number of cattle per silage, and the number of days in the feeding period.

³As a percent of the crop dry matter ensiled.

^ATrial conducted at the Southeast Kansas Branch Station.

*Treated silage differs from the control silage (P<.05).

Table 20.2. Effect of Inoculants and Non-protein Nitrogen Additions on Dry Matter Recovery and Cattle Performance in 10 Trials with Forage Sorghum Silage

Trial No., Year, and Rpt. of Progress No. ¹	Treatment ²	DM Recovery ³	Avg. Daily Gain, lb	Daily DM Intake, lb	DM Feed/lb of Gain, lb	Gain/Ton of Crop Ensiled, lb	
1.	1979:394	Control (33,18,84)	91.0	1.17	12.5	10.70	64.0
		Sila-bac	90.7	1.31	12.1	9.23*	74.0
		Cold-flo	84.9	1.08	11.2*	10.34	62.2
2.	1980:413 ^A	Control (30,15,81)	78.1	2.56	14.5	5.67	82.6
		Sila-bac	81.1	2.52	13.8	5.48	88.8
		LSA-100	77.2	2.75	15.1	5.49	84.5
3.	1981:427 ^A	Control (29,15,70)	80.0	1.87	14.7	8.11	59.2
		LSA-100	76.0	1.96	14.0	7.22	63.1
4.	1981:427	Control (43,12,56)	84.4	1.74	12.5	7.23	70.0
		1177	87.0	1.65	11.9	7.18	72.7
		LSA-100	76.2	1.98	13.5	7.21	63.4
5.	1982:448	Control (30,15,56)	85.6	1.77	11.9	6.82	90.2
		Fermentrol	87.8	1.94*	13.0*	6.78	90.8
		Urea	83.6	1.09*	10.8*	10.08*	60.5
6.	1982:448	Control (25,18,94)	77.2	1.18	10.9	9.33	59.8
		Silo-Best	82.3	1.10	10.0*	9.13	66.2
		1177	79.1	1.20	10.8	9.02	65.1
7.	1983:470	Control (28,12,84)	86.5	1.10	11.4	11.04	69.5
		Urea	79.3	1.08	11.9	11.31	59.5
8.	1984:494	Control (33,16,56)	81.4	1.94	14.1	7.33	76.8
		USO ₃ M	81.6	1.96	13.6	6.90	81.2
9.	1987:567	Control (30,15,75)	90.8	2.07	18.4	8.94	69.8
		TriLac	91.9	2.08	18.0	8.70	72.7
10.	1987:567	Control (32,15,75)	84.3	1.71	15.0	8.82	65.7
		Silagest	85.3	1.84*	15.1	8.23*	71.1

¹Identifies the KAES Report of Progress which contains detailed procedures and results for each trial.

²In parenthesis are the percent dry matter of the pre-ensiled crop, the number of cattle per silage, and the number of days in the feeding period.

³As a percent of the crop dry matter ensiled.

^ATrial conducted at the Fort Hays Branch Station.

*Treated silage differs from the control silage (P<.05).

Table 20.3. Summary of Treatment Means for Dry Matter Recovery and Cattle Performance from Inoculant and NPN Additions to Corn and Forage Sorghum Silages

Crop and Silage Treatment	Number of Silages	DM Recovery ¹	Avg. Daily Gain, lb	Daily DM Intake, lb	Feed/lb of Gain, lb	Gain/Ton of Crop Ensiled, lb
<u>Corn:</u>						
Control	12	90.35	2.42	17.10	7.09	99.8
Inoculant	16	91.8	2.49	17.25	6.99	103.3
Probability Level	--	.001	.01	NS	NS	.001
Control	3	91.5	2.29	17.20	7.52	96.3
NPN	3	89.4	2.22	17.55	7.84	90.0
Probability Level	--	NS	NS	NS	NS	.07
<u>Forage Sorghum:</u>						
Control	8	83.3	1.70	13.40	8.24	71.0
Inoculant	9	85.2	1.73	13.15	7.84	75.9
Probability Level	--	.01	NS	NS	.03	.001
Control	6	84.3	1.70	12.92	8.24	72.5
NPN	6	79.5	1.66	12.75	8.60	65.5
Probability Level	--	.001	NS	NS	NS	NS

¹As a percent of the crop dry matter ensiled.